課題番号 :F-16-NU-0044
利用形態 :共同研究
利用課題名(日本語) :オンチップ細胞計測を基盤とする光合成細胞の外部刺激応答特性の解明
Program Title (English) :Measurement of mechanical properties of single *Synechocystis* sp. PCC 6803 in response to osmotic stress

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1. 概要(Summary)

Synechocystis sp. PCC 6803 is a kind of model organism for the study of photosynthesis, biofuel and environmental stress adaptation. In the adaption mechanism, mechanosensitive channels play important roles that they work as a kind of regulator to response intracellular pressure relating to osmotic condition of culture medium. Thus, we can evaluate the activity and role of the mechanosensitive channels by measuring single cellular stiffness by using the robot integrated microfluidic chip.

2. 実験(Experimental)

【利用した主な装置】

マスクアライナ, レーザ描画装置, スパッタリング装置一式, ICP エッチング装置一式, ダイシングソー, Deep Si エッチング装置, ウエハ接合装置.

【実験方法】

Firstly, rectangular substrate chips are cut out from the wafer using a dicing saw. The photoresist on the silicon chips and glass chips are patterned using a mask aligner. The mask used in the patterning process is manufactured by a laser drawing device. After that, metal film formation is performed by using a sputtering device. Then chips are etched by an ICP etching device and a deep Si etcher. Then, the etched glass chip and silicon chip are bonded together by a bonding device. Finally, the backside of the bonded chip is patterned again and etched. Thus, the chip used in our experiment is fabricated.

3. 結果と考察(Results and Discussion)

The microfluidic chip utilized in this research was made of silicon on insulator (SOI) wafer consisting of three layers, a device layer, an intermediate oxide layer and a substrate layer. A stretchable pushing probe and a beam type force sensor were formed in the device layer by microfabrication technology. The pushing probe was connected to the thick silicon substrate layer via the intermediate oxide layer. In this way, we actuated the probe by pushing the thick substrate using a piezo actuator.

The target single cell was moved to the gap between the pushing probe and the force sensor by optical tweezer and then compressed by the probe. By measuring the displacement of the pushing probe and the force sensor, we evaluated the stiffness of the cell, successfully.

4. その他・特記事項(Others)

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5. 論文・学会発表(Publication/Presentation)

(1) D. Chang, S. Sakuma, T. Hasegawa, N. Uozumi, and F. Arai, ロボティクス・メカトロニクス講演会 2016, 平成 28 年 6 月 10 日

6. 関連特許(Patent)

なし.